What is claimed is:

1. A method of nanolithography comprising:

providing a substrate and a tip;

using the tip to apply a patterning compound to the substrate so as to produce a desired pattern which is a chemical etching resist,

chemically etching the substrate.

2. The method according to claim 1, wherein the substrate comprises a metal surface.

3. The method according to claim 1, wherein the substrate comprises a semiconductor.

4. The method according to claim 1, wherein the tip is a scanning probe microscope tip.

5. The method according to claim 1, wherein the tip is an atomic force microscope tip.

6. The method according to claim 1, wherein the tip is a hollow tip.

7. The method according to claim 1, wherein the tip is a non-hollow tip.

8. The method according to claim 1, wherein the patterning compound is supplied to the tip in a continuous manner.

9. The method according to claim 1, wherein the patterning compound is supplied to the tip in a non-continuous manner.

10. The method according to claim 1, wherein the patterning compound can chemisorb or covalently bond to the substrate.

11. The method according to claim 1, wherein the patterning compound is a sulfur-containing compound.

12. The method according to claim 1, wherein the desired pattern comprises a self assembled monolayer.

13. The method according to claim 1, wherein the desired pattern is an array.

14. The method according to claim 1, wherein the desired pattern comprises dots or lines.

15. The method according to claim 1, wherein the pattern after etching comprises a nanogap.

16. The method according to claim 1, wherein the pattern after etching comprises electrodes with a nanogap.

17. The method according to claim 1, wherein the pattern after etching is characterized by features of about 50 nm or less.

18. The method according to claim 1, wherein the pattern after etching is characterized by interfeature gaps of about 100 nm or less.

19. The method according to claim 1, wherein the substrate comprises a metal surface, wherein the tip is a scanning probe microscope tip, and the desired pattern comprises a self-assembled monolayer.

20. The method according to claim 1, wherein the substrate comprises a semiconductor, wherein the tip is an atomic force microscope tip, wherein the etching step is a wet chemical etching step, and wherein the patterning compound can chemisorb or covalently bond to the substrate.

21. A method of nanolithography comprising:

providing a substrate and a tip;

using the tip to apply a patterning compound to the substrate so as to produce a desired pattern which is a chemical etching resist,

chemically etching the substrate,

wherein the pattern after etching is characterized by features of about 50 nm or less.

22. The method according to claim 21, wherein the substrate comprises a metal surface.

23. The method according to claim 21, wherein the substrate comprises a metal surface and silicon.

24. The method according to claim 21, wherein the tip is a scanning probe microscope tip.

25. The method according to claim 21, wherein the tip is an atomic force microscope tip.

26. The method according to claim 21, wherein the tip is a non-hollow tip.

27. The method according to claim 21, wherein after chemically etching the substrate, the etching resist is removed photochemically.

28. The method according to claim 21, wherein the patterning compound is supplied to the tip in a continuous manner.

29. The method according to claim 21, wherein the patterning compound is supplied to the tip in a non-continuous manner.

30. The method according to claim 21, wherein the patterning compound can chemisorb or covalently bond to the substrate.

31. The method according to claim 21, wherein the patterning compound is a sulfur-containing compound.

32. The method according to claim 21, wherein the desired pattern is a monolayer.

33. The method according to claim 21, wherein the desired pattern is an array.

34. The method according to claim 21, wherein the desired pattern comprises dots, lines, circles, or triangles, or combinations thereof.

35. The method according to claim 21, wherein the pattern after etching comprises a nanogap.

36. The method according to claim 21, further providing the step of providing the pattern with biomolecules or nanoparticles disposed on the pattern.

37. The method according to claim 21, wherein the pattern after etching is characterized by features of about 25 nm to about 50 nm.

38. The method according to claim 21, wherein the pattern after etching is characterized by interfeature gaps of about 100 nm or less.

39. The method according to claim 21, wherein the etching step is a wet chemical etching step, wherein the tip is a scanning probe microscope tip, and the desired pattern comprises a self-assembled monolayer.

40. The method according to claim 21, wherein the substrate comprises a metal surface, wherein the tip is an atomic force microscope tip, and wherein the patterning compound can chemisorb or covalently bond to the substrate.

41. A method of nanolithography comprising:

providing a substrate and a tip;

using the tip to apply a patterning compound to the substrate so as to produce a desired pattern which is a chemical etching resist,

chemically etching the substrate,

wherein the pattern after etching is characterized by interfeature gaps of about 100 nm or less.

42. The method according to claim 41, wherein the substrate comprises a metal surface.

43. The method according to claim 41, wherein the substrate comprises a metal surface and a semiconductor.

44. The method according to claim 41, wherein the tip is a scanning probe microscope tip.

45. The method according to claim 41, wherein the tip is an atomic force microscope tip.

46. The method according to claim 41, wherein a plurality of tips is used to apply a plurality of patterning compounds.

47. The method according to claim 41, wherein the tip is a non-hollow tip.

48. The method according to claim 41, wherein the patterning compound is supplied to the tip in a continuous manner.

49. The method according to claim 41, wherein the patterning compound is supplied to the tip in a non-continuous manner.

50. The method according to claim 41, wherein the patterning compound can chemisorb to the substrate.

51. The method according to claim 41, wherein after chemically etching the substrate, the etching resist is removed photochemically.

52. The method according to claim 41, wherein the desired pattern comprises a self assembled monolayer.

53. The method according to claim 41, wherein the desired pattern is an array comprising metal features, semiconductor features, or combinations thereof.

54. The method according to claim 41, wherein the desired pattern comprises dots, lines, circles, triangles, or combinations thereof.

55. The method according to claim 41, wherein the pattern after etching comprises a nanogap between lines.

56. The method according to claim 41, wherein the pattern after etching comprises a nanogap of about 20 nm or less.

57. The method according to claim 41, wherein the pattern after etching is characterized by features of about 50 nm or less.

58. The method according to claim 41, wherein the pattern after etching is characterized by interfeature gaps of about 12 nm to about 100 nm.

59. The method according to claim 41, wherein the substrate comprises a semiconductor, wherein the tip is a scanning probe microscope tip, and the desired pattern comprises a self-assembled monolayer.

60. The method according to claim 41, wherein the substrate comprises a metal surface,. wherein the tip is an atomic force microscope tip, and wherein the patterning compound can chemisorb or covalently bond to the substrate..

61. A method for direct write nanolithography consisting essentially of:

providing a substrate and a plurality of computer controlled scanning probe microscope tips;

using the tips under computer control to apply a patterning compound to the substrate so as to produce a desired pattern, wherein the patterning compound is a chemical etching resist,

chemically etching the substrate, etching away substrate not patterned by the resist,

wherein the pattern after etching is characterized by interfeature gaps of about 100 nm or less, or by features of about 50 nm or less.

62. The method according to claim 61, wherein the pattern after etching is characterized by interfeature gaps of about 100 nm or less and by features of about 50 nm or less..

63. The method according to claim 61, wherein the scanning probe microscopic tip is an atomic force microscopic tip.

64. The method according to claim 61, wherein the patterning compound is chemisorbed to or covalently bonded to the substrate after application.

65. The method according to claim 61, wherein the desired pattern comprises a self-assembled monolayer.

66. The method according to claim 61, wherein the pattern after etching is characterized by interfeature gaps of about 100 nm or less and by features of about 50 nm or less, the scanning probe microscopic tip is an atomic force microscopic tip, the patterning compound is chemisorbed to or covalently bonded to the substrate after application, and the desired pattern comprises a self-assembled monolayer.

67. A patterned substrate prepared by the method according to claim 21.

68. A patterned substrate prepared by the method according to claim 41.

69. A patterned substrate prepared by the method according to claim 61.

70. A nanoarray comprising semiconductor line or pillar features of about 5 nm to about 50 nm and interfeature distances of about 5 nm to about 50 nm.

71. The nanoarray of claim 70, wherein the interfeature distances are about 5 nm to about 20 nm.

72. A nanoarray of claim 70, wherein the features further comprise a metallic or biomolecular component.

73. An article comprising a substrate and semiconductor features with one or more nanogaps of about 20 nm or less.

74. The article according to claim 73, wherein the features are semiconductor pillar or line features.

75. The article according to claim 73, wherein the features further comprise a biomolecular or metallic component.